Environmental Impact Analysis for a New Urban Development

The case of Parc Meridia, Nice Écovallée, France

Aya ALY[1], Paulo MOURA[1], Sabina PICAUD-PIGA[2], Damienne PROVITOLO[3], Audren CERLES[2], Emmanuel TRIC[1]

1. Université Côte d'Azur – Institut Méditerranée du Risque, de l'Environnement et du Développement Durable (IMREDD),
2. Établissement Public d'Aménagement (EPA), 3. UMR Géoazur - CNRS - Université Côte d'Azur – IMREDD.

1. Context & Objectives

The project* aims to **build a decision-support method** that helps planners **evaluate the environmental impact of proposed urban developments** through an integrated transport and spatial modelling framework. The model simulates expected traffic flows across different scenarios of the study area and **analyses carbon emissions, noise pollution, and travel time losses**, in order to assess the impact of the spatial changes and help identify an optimized configuration for the neighborhood.

**This project is part of the national Call for Expression of Interest (AMI) «Démonstrateurs de la ville durable» (Sustainable City Demonstrators), launched in May 2021 under the France 2030 program and the «Habiter la France de Demain» (Living in the France of Tomorrow) initiative. The program aims to foster the emergence of sustainable, resilient, inclusive, and productive cities, thereby accelerating the ecological transition. It is operated by the Banque des Territoires and the ANRU on behalf of the French State.*

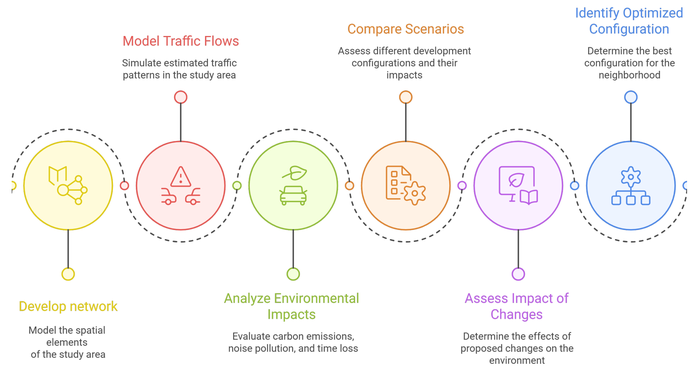

Figure 1 : General framework of the project.

2. Methodology

The study area is modeled including its land-use composition, urban program, road hierarchy, and connections. A **digital representation of the neighborhood and its surrounding transport network is constructed in SUMO software**, through node-edge topology, intersection control, and road configuration (including speed, number of lanes, direction, pedestrian crossings, bike lanes, etc.). Land-use parameters are used to estimate trip generation and distribution. Travel demand is estimated based on average trip rates identified by specialized entities such as CEREMA[1] *(Center for Studies and Expertise on Risks, the Environment, Mobility, and Development)* and *ITE*[2] *(the Institute of Transport Engineering)*, among others. **The trips are allocated to the road network, defining their origin and destination, incorporating vehicle flows, their density, speed, and modal split.**

The scenarios represent different **proposed master plans** for the neighbourhood, each scenario is modeled and simulated following the explained procedure, after which the simulation is executed to analyze the resulting traffic dynamics and impact.

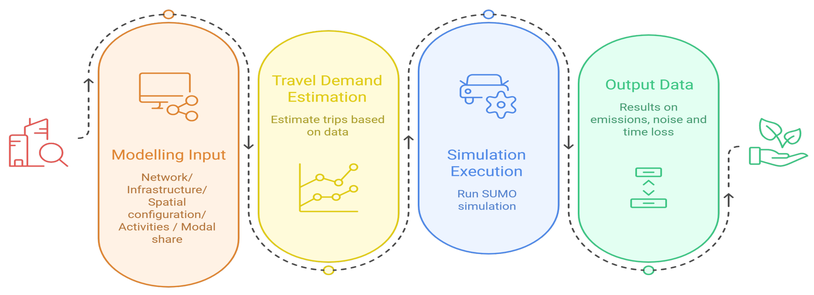

Figure 2: The applied methodology of the project.

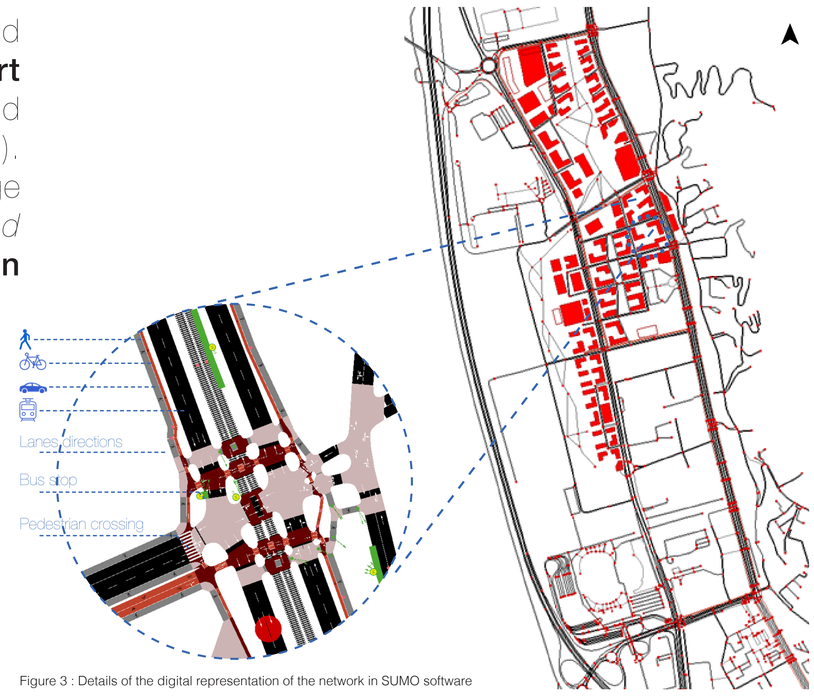

Figure 3 : Details of the digital representation of the network in SUMO software

3. Results

The simulation generates the outputs which include the *«edge-lane emissions»* output containing **pollution emissions** (CO_2, NO_x and PM_x) (represented in Kg). **Noise emissions** (in dB) from the *«edge-lane noise»* output are calculated using the built-in «Harmonise» model. Finally, **time lost** (in mins) in traffic is derived from the *«edge-lane traffic»* output, as well as *«trip_info»* for detailed information about each trip regarding time loss, waiting time and other parameters. The results are then analysed and visualised through spatial and graphical representations.

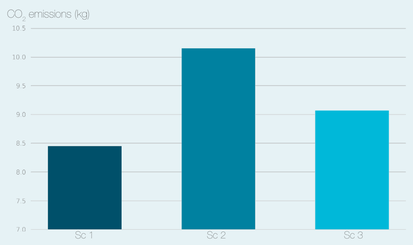

Figure 5: Comparaison of CO_2 emissions for 3 scenarios.

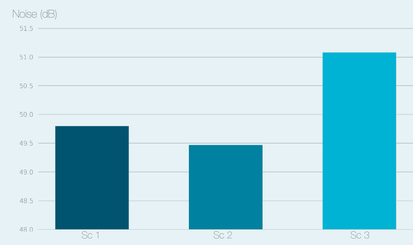

Figure 6 : Comparaison of Noise levels for 3 scenarios.

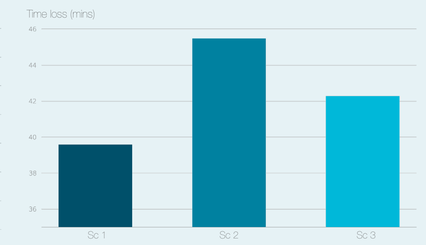

Figure 7 : Comparaison of time loss for 3 scenarios.

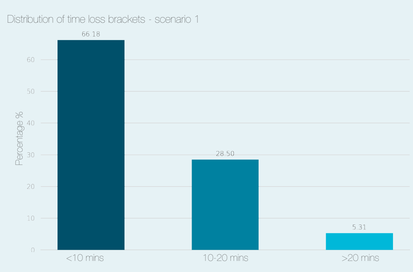

Figure 8 : Distribution of time loss - Scenario 1

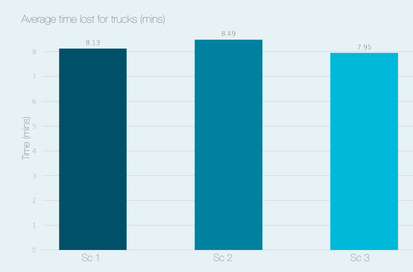

Figure 9 : Average time loss of delivery trucks for 3 scenarios

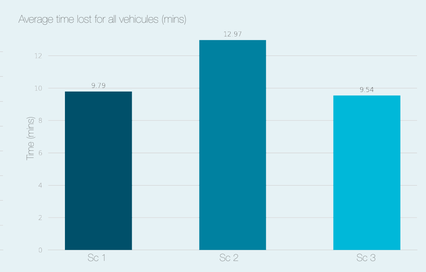

Figure 10 : Average time loss of all vehicules for 3 scenarios

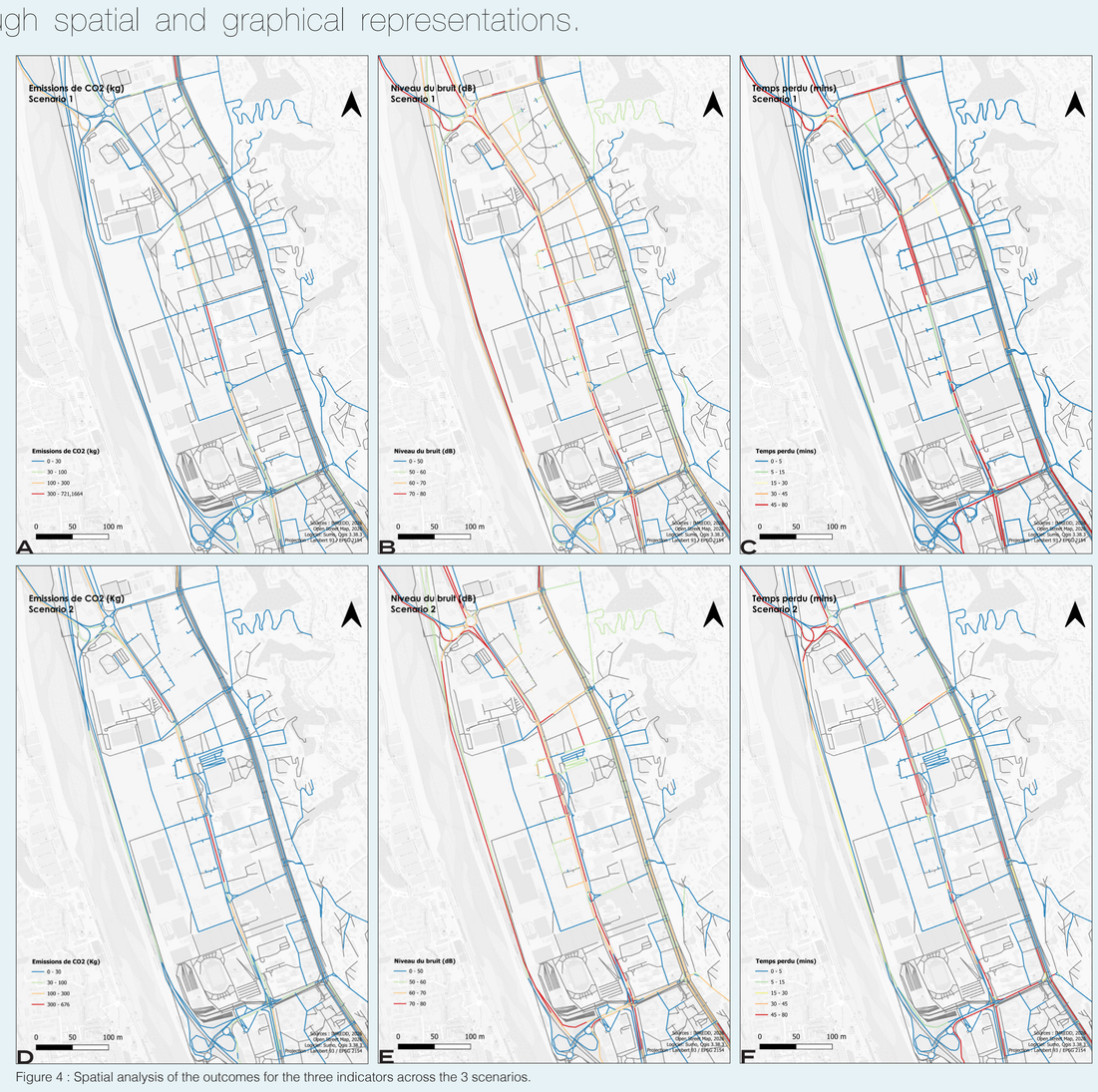

Figure 4 : Spatial analysis of the outcomes for the three indicators across the 3 scenarios.

The results are represented through spatial maps in (Fig. 4) for the three key environmental and transport indicators. **Each indicator is mapped across the road network** using a colour-coded linear representation, where each road segment is assigned a colour according to the intensity of the indicator, ranging from blue for low values to red for the highest. This allows for an intuitive reading of the **spatial distribution of impacts**, highlighting which corridors concentrate the most significant environmental burdens.

Travel time losses reveal **congestion hotspots** across the network (Fig.4 D and F). **CO_2 emissions** are mapped per segment and benchmarked against official data from CEREMA and ADEME *(Agence de la transition écologique)*[4]. **Noise levels** (in fig.4 B and E) are assessed against the health and safety thresholds established by ANSES *(Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail)*, identifying road sections where traffic may exceed recommended exposure limits.

Beyond the spatial data, the study produces **quantitative outputs** enabling a direct numerical comparison of scenarios across the three key indicators, summarised through bar charts in (fig. 5, 6 and 7). For travel time specifically, results are further broken down by **average time lost per segment, per vehicle** (fig. 9), and **by time-loss bracket** (fig. 8), providing a nuanced picture of how congestion affects both the network and individual users across scenarios.

4. Conclusions and limitations

In conclusion, this study provides a comprehensive assessment of the environmental and mobility impacts associated with the traffic generated by the neighborhood development, through microsimulation modeling using SUMO, covering key indicators including CO2 emissions, noise levels, and travel time loss. The results, validated against French national reference values, confirm the overall consistency of the modeling approach and offer a reliable basis for comparing the different development scenarios. However, the results should be interpreted with caution. The prospective nature of the project required numerous assumptions throughout the trip generation process, introducing a margin of approximation. Furthermore, the computed noise and emission levels solely reflect pollutants generated by simulated vehicles, excluding other urban sources as well as any absorption or dispersion phenomena. The data therefore represent raw vehicle traffic outputs and should not be considered an exhaustive assessment of the neighborhood›s air quality or acoustic environment.

References

1. "Quantifier et localiser les aires de livraison | Cerema," at Cerema [on line]. https://www.cerema.fr/fr/actualites/quantifier-localiser-aires-livraison
2. "ITETripGen Web-based App." https://www.itetripgen.org/
3. "Évaluation des impacts sanitaires extra-auditifs du bruit environnemental," Avis De L'Anses, [s. l.], 2013. https://www.anses.fr/en/system/files/AP2009sa0333Ra.pdf
4. "Emissions routières des polluants atmosphériques - courbes et facteurs d'influence," at Cerema [on line]. https://doc.cerema.fr/Default/doc/SYRACUSE/20326/emissions-routieres-des-polluants-atmospheriques-courbes-et-facteurs-d-influence.

SUMO conference 2026
June 01- 04 | Berlin-Adlershof, Germany